Locational Valuation Methodologies in Distribution Resource Plans

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Locational Valuation Methodologies

- The Guidance Ruling directs IOU's to develop a *unified locational* net benefits methodology

- Methodology is based on E3's Distributed Energy Resources Avoided Cost Calculator (DERAC), with added value components

- Three steps in determining locational impacts of DER:
  - Determining the impact of the DER on the electric grid
  - Translating that into cost for each of the value components
  - Aggregating it into a single net present value

Locational Valuation Methodologies

- Value components in methodology include
  - T&D Capital and Operational Costs
    - Transmission, Sub-Transmission, Substation, and Feeder
    - Reliability and Resiliency
    - Voltage and Power Quality
  - Impact on Resource Adequacy (RA) costs
  - System RA, Flexible RA (ramping; may include logic to mimic dispatch)
  - Energy Generation (includes GHG costs) and Ancillary Services (AS) procurement
  - Energy Losses (at this point simple engineering principles)
  - RPS procurement
  - …

Deferral of T&D Capital and Operating Costs

Granularity: Feeder and Substation (Transmission)

- Methodology proposes calculating the difference between deferral benefits and capacity-related costs for interconnecting DER
- Minimum 3 year deferral (currently)

$$TD_y = \frac{TDCapital_{y,inv} * Inflation_{inv} * RRScaler_{y,inv} * \left(1 - \left(\frac{1 + i_{inv}}{1 + r}\right)^{\Delta t}\right)}{(1 + r)^{(y - StartYr)}}$$

Impact on Resource Adequacy

Granularity: System and Local Capacity Req. Area; Load Serving Entity Area

- Methodology suggests the use of an Effective Load Carrying Capability (ELCC) to determine net impact on RA procurement using hourly (mostly standard?) DER profiles, *flexible RA might include logic for controller*
- Economic impact on RA procurement is quantified by forecasting RA prices based on CAISO's studies
- Public use of proprietary data is prevented to avoid market disruptions (market power)

Energy Generation, AS Procurement, Losses, and RPS

Granularity: CAISO Pricing Node; line section; Load Serving Entity Area

- Method uses *typical* (static?)*DER profiles*
- To estimate net impact on energy procurement needs Energy price forecasting (including GHG) based on CAISO data
- AS prices are estimated based on energy prices using a rule of thumb and E3's DERAC
- Losses are estimated based on DER profiles (static?): self-generation will reduce losses (simple engineering principles)
- DER impacts in Renewable Portfolio Standards procurement are estimated proportionally to the net impact in electricity sales (also uses E3's DERAC)

Observations on Capacity and Operations

Capacity

- 87% of PGE's substation transformers are loaded with less than 90% capacity and 65% are loaded with less than 80%→ suggests no major transformer problem and thus *DER cannot contribute to mitigate to a problem, since there is no problem*

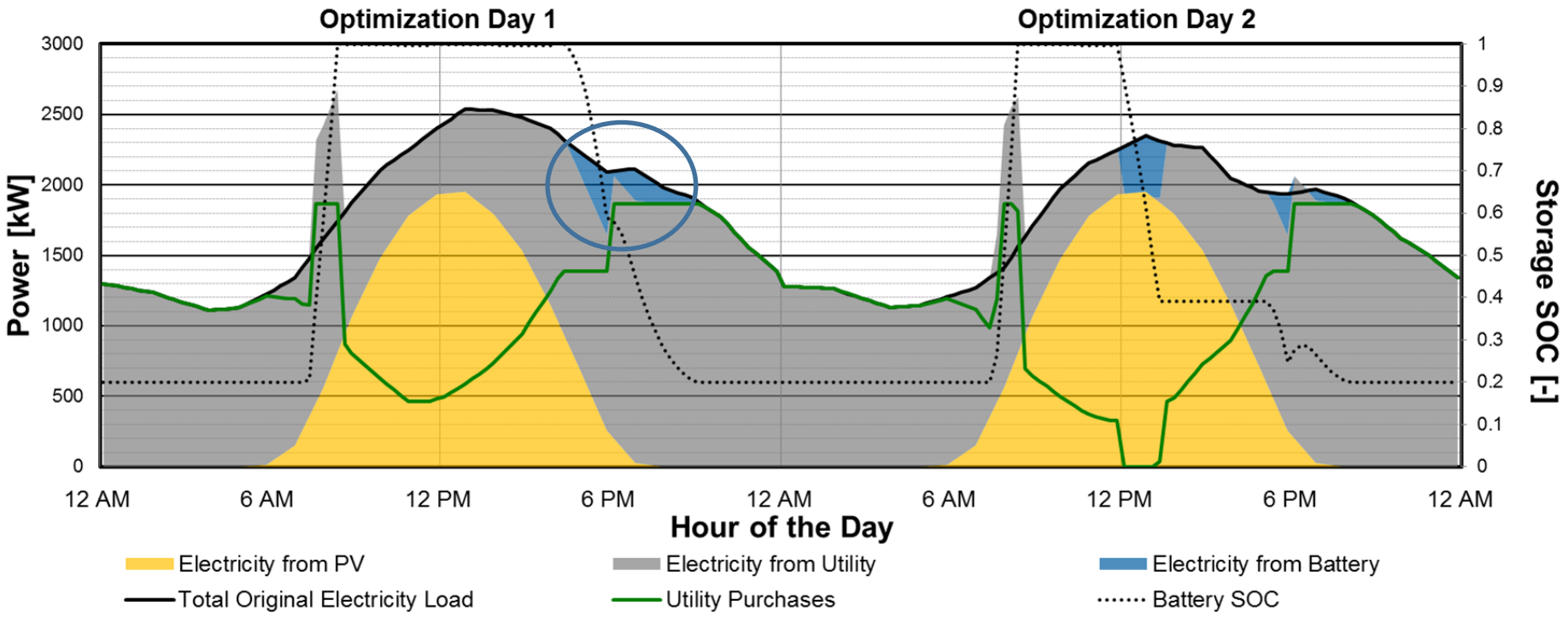
- Current methodology addresses all major components relevant to the economic impact of DER *from IOU's perspective*

- Several elements on the methodology rely on "standard" (static) DER profiles – e.g. "stand-alone PV" or "PV and storage"

Operational Strategy

- It is suggested that focus is given to operational strategies, particularly in the presence of multiple DERs – anticipate smart DER controls of generation + storage + DR solutions

Observation on Peak Mitigation



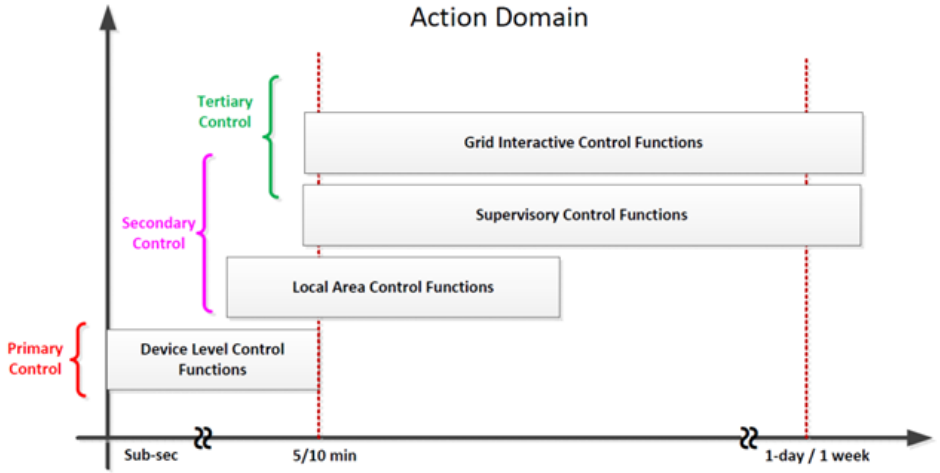
- Standalone "PV profile" can be altered significantly if coupled with storage
- Non-PV DERs (DG) can equally be used to reduce system loads
- Impact on T&D capacity deferral
  Currently PGE system peak around 4 PM to 6 PM; thus standalone PV cannot really mitigate peak; what if coupled with storage and controlled for system peak mitigation?
  → **market/price signals**

Observations

Developments in microgrid controllers may significantly alter the way we use DER (e.g. IEEE 2030.7), e.g. *voltage support*

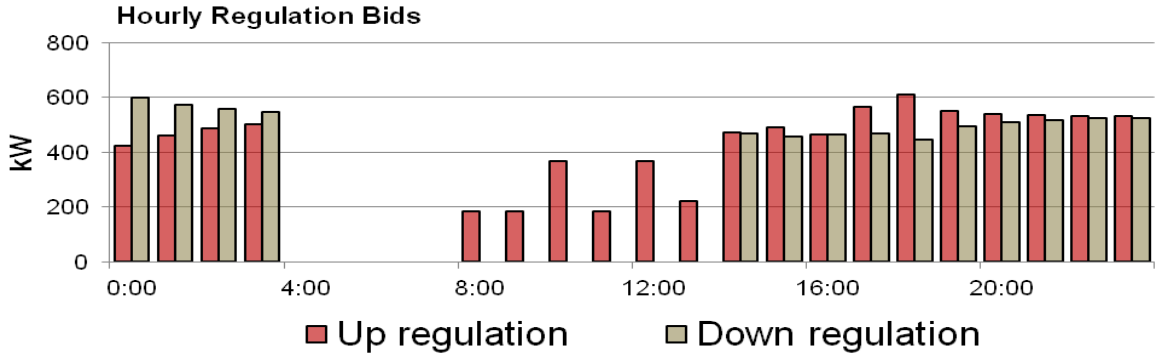
Function Assignment

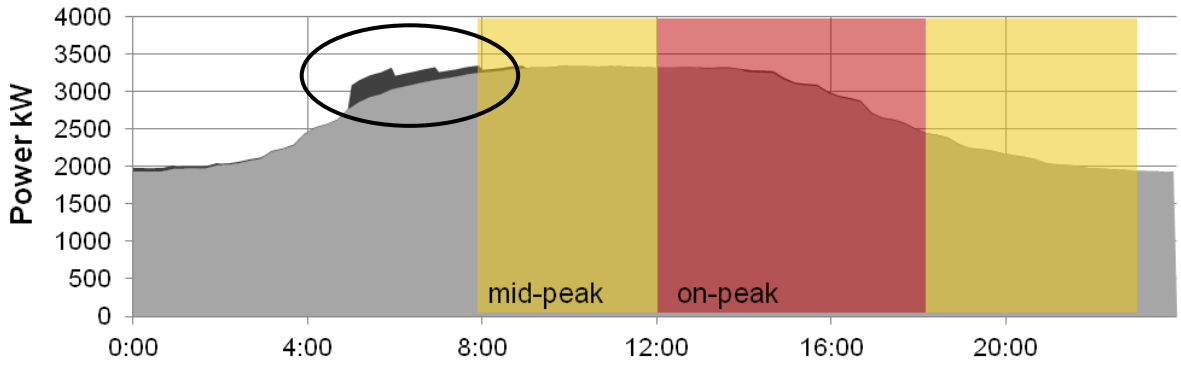
Block 4	**Grid Interactive Control Functions** (Area EPS control, Spot Market, DMS, TSCADA, Connection to adj. Microgrid)
Block 3	**Supervisory Control Functions** (Forecasting, Data management and Visualization, Optimization [e.g. Volt/ VAR, Economic dispatch], Dispatch, State Estimation, Emergency Handling, Generation Smoothing, Spinning Reserve, Topology Change Management, Black Start, Protection Coordination)
Block 2	**Local Area Control Functions** (Sequence Logic/Status control, Load Management, Building Energy Management, Plant Controller, AGC, Fast Load Shedding, Resynchronization, Disturbance Recording)
Block 1	**Device Level Control Functions** (Voltage/Frequency Control, Reactive power Control, Electric Vehicle Control, Energy Storage Control, Load Control, Generation Control, Islanding Detection, Fault Protection)



Observations

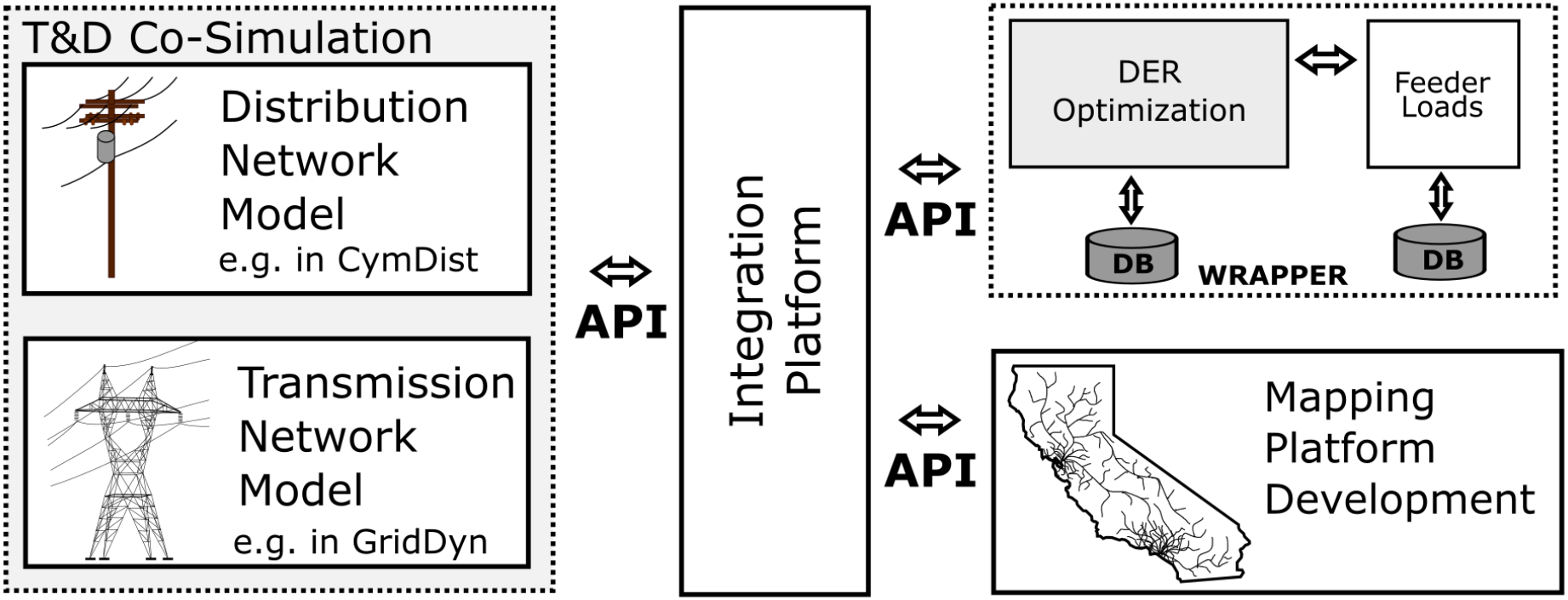
- It is suggested that greater focus is given to Ancillary Services
- Greater detail in analyzing DER participation in AS markets can improve methodology
- Anticipated participation in AS markets may influence DER profiles





Recommendation for Integrated Approach

Current methods suggest single node analyses, which could be improved by an integrated approach (e.g. cross feeder analysis)



Suggestions

Future opportunities and developments should consider:

- Local Energy Markets

  Take into account the tradeoff between providing ancillary services through the T&D network, or locally through microgrids (local RA and AS procurement?)

→Holistic Integrated dynamic modeling (optimization) of central generation and local generation resources (bi-directional flow) considering the grid and its conditions

Locational Valuation Methodologies

Questions and comments are very welcome!